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ON
SYSTEMATIC
ZOOLOGY

B. CLARKE

A
NEW ARRANGEMENT
OF
THE CLASSES OF ZOOLOGY,
FOUNDED ON
THE POSITION OF THE OVIDUCTS AND OVARIES,
INCLUDING
A NEW MODE OF ARRANGING THE MAMMALIA,

BY

BENJAMIN CLARKE, F.L.S., & M.R.C.S.

Methodi Naturalis Fragmenta studiose inquirenda sunt. Primum et ultimum hoc in Botanicis desideratum est. Linnæi Philosophia Botanica, Ed. secund. p. 27.

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189. d. 155

AN IMPRESSION ON SEEING THE GREAT SOUTH AMERICAN WATER LILY (*Victoria regia*) AT KEW GARDENS.

Hail! stranger denizen of other climes,
That spreadeth forth so calmly beautiful
Thy palm-like leaves upon the silent waters,
Making the limpid element reflect His praise,
Whose workmanship thou art, whose hand
Hath made the river flowers.
How happy is the heart reviving thought
That neither death nor life with all its snares,
Nor angels, powers or principalities,
Nor present things nor things unseen to come,
Nor any other creature fair delusive,
Shall e'er avail to separate us from
His love whose gift munificent thou art.
Stranger from distant climes in thee are seen
His wisdom, power and goodness beyond thought,
For which of all the forest's leafy grandeur,
Hath more of form and loveliness than thou?
In silent mystic beauty floating thus
Upon the waters.*

B. Clarke.

ON ENTERING A CONSERVATORY OF TROPICAL PLANTS.

Lo! the stately Palm-trees rise,
Soaring to the azure skies.
Telling of the worlds on high,
Links of their sublimity.

Fern-trees there with graceful mien,
Spread around their domes of green,
Ever fresh their leaves unfold,
Pure and clear as emerald;

Emblems meet of Charity,
In age they never show decay,
Never is their foliage cast,
Young it springeth to the last.

Screw-pines there with buoyant stem,
Bearing many a cone-like gem,
As their leafy heads they raise,
Speak their mighty Maker's praise.

Banyans there with widening bound,
Arching o'er the shadowed ground,
Thickly girt with tropic flowers,
Imitate old Eden's bowers.

Pure and sacred be each thought,
By the better influence taught,
While our hearts within us glow,
Mindful whence all blessings flow.

B. Clarke.

NATURAL HISTORY FROM ITS COMMENCEMENT

IN THE EARLY AGES OF THE EARTH'S FORMATION.

In caverns rugged, deep and wild,
In which the sun hath never smiled,
E'en there the power of God is seen,
And there his mighty hand hath been.

Lo! there is seen the Ammonite,
And there the ancient Trilobite;
The first of living creatures they
That felt the kindly beams of day.

Then came the floating Ichthyosaur,
Like man of might prepared for war,
And Iguanodon's giant power
Made all contending creatures cower.

Then midst the solitudes profound,
The ancient pines their stations found,
And witnessed to the azure sky
The glory of Divinity.

Again the awful word went forth,
And great Behemoth sprang from birth,
His stately form and massive head,
Their shadow on the landscape shed.

The wondrous Megatherium,
What creature dared compete with him?
The thrust of foe his mail ne'er felt,
Death was by him in one blow dealt.

Say, what hath not Jehovah wrought?
His works excel beyond all thought,
And prophets and apostles join
To glorify the hand divine.

Now are the hills with forests crown'd,
With flocks and herds the plains abound.
The vales and woods now gleam with flowers,
And notes of songsters cheer the hours.

Join all that dwell on mountains steep,
With all that throng the valleys deep,
Join all the earth from shore to shore,
In praise and blessing evermore!

B. Clarke.

THE DAISY,

BY

Dr. John Mason Good.

Not worlds on worlds in phalanx deep,
  Need we to prove a God is here,
The Daisy fresh from winter's sleep,
  Tells of His hand in lines as clear.

For who but He who arch'd the skies
  And pours the day spring's living flood,
Wondrous alike in all He tries,
  Could rear the Daisy's purple bud?

Mould its green cup, its wiry stem,
  Its fingered border, nicely spun,
And cut the gold-embossed gem
  That, set in silver, gleams within?

And fling it unrestrain'd and free,
  O'er hill and dale and desert sod,
That man where'er he walks may see,
  In every step the stamp of God.

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* The mystic beauty and indescribable loveliness which covers the works of creation, seen from any great elevation in the early morning, before and at the time of the sun's rising, is under favourable circumstances, distinctly brought to mind on seeing for the first time this water-lily.

A
NEW ARRANGEMENT
OF
THE CLASSES OF ZOOLOGY.

THE PRINCIPLES OF THE ARRANGEMENT.

AFTER having for some years very carefully studied the most doubtful points as regards the position of the oviducts and ovaries in their relation to the alimentary canal, the present classification is offered as an attempt, believing that it will prove successful, to demonstrate that there exists a systematic relation between the Animal and Vegetable Kingdom; and, in fact, from the very close approach of the principles of Zoology and those of Botany this might be expected, if not regarded as certain, although it is as yet become known scarcely more than as an analogy. The influence that the relative position of the ovary, when consisting of a single carpel, to the axis of the flower, has, on the arrangement of a large part of the Orders, has been explained in a work of mine, "A New Arrangement of Phanerogamous Plants,"* and it is the principles of that arrangement which have led to this proposed arrangement of the Classes of Zoology.

A very prominent difference between a true and a false system is, that if an error in the position of a Natural Order is detected in a true system (*i.e.*, the principles of which are true), the system is decidedly and obviously improved by placing that Order in its right and natural station. But when an error of the same kind is detected in a false system, and the misplaced Order is placed with its nearest affinities, the inconsistency of the arrangement becomes greater than before. By this rule the present proposed system will stand or fall.

The alimentary canal is taken as the axis throughout the entire animal kingdom. Its normal position appears to be the centre of the body, from the highest point of the head, or nearly so, to the extremity of the tail, not materially varying in any direction, as in many of the Annelida. It, however, usually becomes more or less displaced from this position, especially in its lower portion, so that the anal opening becomes anterior, and in a part of the Gasteropoda this opening is high up on the body; but in the Rotifera a displacement in the opposite direction takes place, so that the opening is on the posterior side of the body. But this occasions no difficulty with regard to the position of the uterine tube or oviducts, as they always alter their position to the same extent as the intestine, so that the orifices of these tubes are either before or behind the anal opening, just the same as if the alimentary canal were quite straight.

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* Of this work there are copies in the Libraries of the Linnean and Zoological Societies.

The primitive situation of the ovaries and their ducts, whether two or only one, in the Annulose and Vertebrate, Divisions v. Table II., proves to be, as far as my observations have extended, always on the posterior side of the alimentary canal, as in Fishes, the lower Ascidioida, Polyzoa and Holothuridea; and where that canal is absent, as in *Paramœcium bursaria,* among the Infusoria the ovary is situated on the posterior side of the body (*i.e.*, on the side opposite to the mouth and gullet), to which it is fixed near the surface. I have, therefore, provisionally classed all the lower Sub-Divisions and Orders of the Invertebrata, in which the position of the ovary cannot be ascertained, *e.g.*, Spongida, as Notodelphian, *i.e.*, having the ovary posterior. As development advances the single ovary divides into two, each with its separate duct, lying in close apposition with each other behind the alimentary canal, where they open, as in the Teleostea among Fishes, and in the Amphibians and Reptiles; their ducts then become lateral in their relation to it being nearer to the posterior than to the anterior surface in Birds (where there usually is but one), and nearly in front of it in the lower Mammals. And finally, in the highest Vertebrata and Invertebrata the oviduct becomes single by the junction of the two directly anterior to the alimentary canal, forming in the highest Mammalia a womb, which is the climax of development.* On this principle no animal in which the oviduct is directly anterior, can give origin to one in which there is either one oviduct posterior, or two lateral, or even two anterior.

This gradual alteration in the position of the ovaries and their ducts, whether from original development or subsequent alteration, in successive Sub-divisions, takes place in all the Races of the Animal Kingdom proposed in the accompanying Table; in the Vertebrate Division (Race of the Polyzoa), very gradually; in the Annulose Division (Race of the Spongida), sooner; and in its upper section the Annulosa so immediately that intermediate transitions are comparatively few.

In plants, however, when the single carpel is anterior to the axis of the flower, it is so by original development, the lateral and posterior carpels remaining undeveloped, but it is a rule without an exception that a single carpel posterior to the axis of the flower, and in the Animal Kingdom ovaries and oviducts posterior to the axis of the body, *i.e.*, the alimentary canal, show a comparatively low degree of development. In the Vertebrata this is effected by alteration of position, but in plants it is effected simply by the suppression of one part and the development of another, and also not improbably in the Invertebrata, in some instances at least.

The position of the oviduct, ovary, or carpel posterior, therefore, does not show retrograde development as regards the entire animal or vegetable kingdom, *but only that the animal or plant is a retrograde, or else a less advanced form of some nearly allied natural order.*

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* The anterior position of the uterus may be regarded as the same kind of indication of high development, as the descent anteriorly and external appearance of the testes; and the existence of a single uterine tube posterior to the alimentary canal as an evidence of an inferior type, like that of abdominal testes.

Zoologists, like botanists, are very anxious, or even more so, to have clearly defined separating characters for every kind of division and section, as well as for genera and species, and therefore, one of the first enquiries will of course be, by what characters are the Vertebrate Division or Race of the Polyzoa separated from the Annulose Division, or Race of the Spongida? This question, on further consideration, no doubt they would be able to answer for themselves, it being obvious that there exists no single character separating them; or if characters were found they would be too extensive and complicated to be of any service. This difficulty I mention more especially for the purpose of giving an answer to the question as to whether there are any characters that can be made use of in separating the Epigynous Division of Exogens (which is a vertical divison), from the Hypogynous and Perigynous Divisions? This, most botanists are aware, would be an impossibility because the Epigynous Division contains numerous perigynous genera, and the Hypogynous and Perigynous Divisions numerous epigynous genera.

From the foregoing principles, it appears quite certain that it will prove to be a rule that all races terminate in a class in which the oviduct is anterior and single; if so, there are only four races in the Animal Kingdom terminating severally in the Mammalia, Pulmogasteropoda, Insecta, and Hirudinea, v. Table II. And also that all classes in which the oviduct is posterior, are basal classes, giving origin to a large mass of higher developed families; thus Fishes, as is well known, give origin to all the Vertebrata above them. Echinodermata are therefore a basal class (v. Holothuridea) which should give origin to a very large mass of highly developed families, and unless Annelida and Insecta are derived from them, the position of the oviduct in Holothuridea would depart from an otherwise, I believe, unexceptionable rule. The same is, in all probability, true with regard to Cœlenterata, *i.e.*, the ovary not being anterior it is a basal class, and, being very large, should have a large branch of not less dimensions than the Echinodermata. It seems very unlikely that Cœlenterata should be branchless, considering its position among the Invertebrata, as such a stoppage of development would—I believe—be without a parallel, either in the Animal or the Vegetable Kingdom.

However impracticable the vertical Divisions in Table II. may at first sight appear, I cannot doubt that they are of more systematic value, as regards the *really natural system*, than horizontal Divisions, such as Vertebrate and Invertebrate,* and—in botany—such as Monopetalous, Polypetalous, and Apetalous, when made use of as primary Divisions, which—when taken in their full extent—appear to me entirely artificial, separating among plants very nearly allied families, which even the artificial system of Linnæus for the most part, if not entirely, combines, such as *Caprifoliaceæ* and *Cornaceæ*. The only alternative for escaping these artificial horizontal Divisions is to find out the vertical method of division, which, if it exists anywhere (and it is certain that the Endogens are so separated from Exogens, and the Epigynous Division of the latter from the Hypogynous and Perigynous Divisions), may be expected to be found everywhere, both in the Animal and Vegetable Kingdom. In fact, it is evident that to form a system truly natural in all its parts, all vertical Divisions must be completed before any horizontal Divisions or sections are introduced, because the vertical depend on completely isolated races in which one family is derived from another throughout each of them; and all the horizontal (when not consisting of a single class) on the combination of sections of several completely isolated races. In the accompanying Tables it will be seen that while horizontal Divisions are never lost sight of, yet they always occupy only secondary or very subordinate positions, and exert very little influence in making the system natural as a whole, which *depends simply* on the vertical Divisions. The divisions Schizocœla and Enterocœla being founded on horizontal characters could not be expected to be of more value in forming a truly natural system than those founded on other horizontal characters, though by no means to be overlooked, as they are obviously very useful in forming sections. The epicœlous character may, however, be regarded as vertical.

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* Nothing can be more satisfactory as a secondary Division than the separation of the Vertebrata from the Invertebrata by a horizontal, and therefore a secondary character (v., Table II., Race of the Polyzoa), but if this is adopted as a primary Division, Mollusca and Molluscoida are entirely separated from the Vertebrata to which they are very nearly allied, and united with Insecta and Annelida to which they have a comparatively distant affinity.

The meaning of the nomenclature in the accompanying Table is so far obvious that it requires no explanation, further than that Prodelphia and Notodelphia refer to the position of the uterus or uterine tubes or oviducts, or ovaries when the oviducts are undeveloped, whether one or two—Prodelphia situated in front of, and Notodelphia posterior to the alimentary canal, Monodelphia referring to one, and Didelphia to two, or one dividing into two, opening externally by two orifices. Where no oviduct is present, of which there are only four instances, the position of the ovaries is taken to supply evidence of affinity and show the natural station of the family. Univasal and Bi- or Plurivasal refer to the aorta originating as a single tube in the Mammals and Birds, and in two or more in the reptiles.* And Teleopodal refers to the homology of the bones or cartilages of the limbs of the Amphibia when present with those of the higher Vertebrata, and Leptopodal to their difference which may be regarded as a deficiency, or at least as showing an inferior type even when most highly developed, inasmuch as that "whether Fishes possess parts corresponding with the humerus, radius, and ulna, &c., or not, certain it is that the elements of their limb skeletons are very differently disposed from the arrangement which obtains in Amphibia and in higher Vertebrates" (Prof. Huxley's Lect. Comp. Anat., p. 64).

MAMMALIA & AVES, TABLE I.

Although the Monotremata have received the name of Ornithodelphia and most correctly, yet the uterine pouches are so distinctly in front of the intestine that their position affords a character separating that sub-class from Birds as distinctly as the anterior position of the uterus in the Monodelphia; and the ovaries are not dorsal as in Birds but are placed more or less forward on the sides in connection with the mesentery. The position of the oviduct in Birds (which is single from the one on the right side being deficient) being very constant, I have particularly examined that of the Common Fowl and find that it is obliquely posterior to the intestine being partially concealed by it in anterior view, and that it is confined in its situation by a reflexion of the serous membrane of the abdominal cavity which attaches it to the back of the pelvis near the junction of the sacrum with the ilium if not entirely to the former, the lower or posterior part of this connecting membrane being for some extent only about an eighth of an inch in breadth. Close to its external opening it is for some extent completely concealed by the intestine in a front view although its orifice seen externally appears as nearly as possible lateral in its relation to the intestine which is produced by the sudden contraction of the latter at the anal aperture. This duct is therefore not so much posterior to the intestine as the two uterine pouches of the Monotremata are anterior to it, but there is so much difference that the term Ornithodelphia should be considered as applying to the presence of two uteri in that division of Mammalia, not to their position, and especially because their orifices are immediately in front of the intestine from which they are further separated by a membranous partition, the wall of the genito-urinary passage.

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* I am not aware of any living exceptions to these characters, but if all the connecting links between Reptilia and Aves were now in existence, not improbably there might be; but if they occurred exclusively in genera connecting these classes, such exceptions might be regarded as instances of *exceptio probat regulum.*

Having in the preceding remarks noticed a difference between the value of vertical and horizontal characters and the greater value of the former, it becomes an interesting question whether the two foremost sets of characters proposed for the sub-divisions of Placentalia belong to one or other of these, because if one of them should be vertical and the other horizontal they could both be very advantageously adopted in conjunction; it being evident that both are very useful in the formation of a *natural* system both in botany and zoology, of the latter of which (*i.e.*, the horizontal) the separation of the Vertebrata (by the presence of a vertebra) is an instance singularly successful. Of the two leading sets of characters proposed for sub-dividing the Placentalia the first, *i.e.*, the Non-Deciduate and the Deciduate are (like the position of oviducts in other departments) evidently vertical characters, agreeably with which they separate Placentalia, with certain exceptions afterwards noticed, into two natural sub-divisions; and as regards the second set, *i.e.*, the cerebral, all the characters of the nervous system are, as far as I can arrive at any degree of certainty horizontal, and therefore they do not interfere with the placental characters depending on the absence or presence of the deciduata. The arrangement however of Mammalia according to the degree of development of the brain (the non-deciduate and the deciduate families being taken separately) may be considered analogous to that of the Mollusca by the presence or absence of a head which up to the present time continues applicable. We might therefore expect that such a character would prove serviceable in the natural system of the Mammalia and whatever exceptions there may be to Prof. Owen's sub-divisions (Linn. Proc. Zool., Vol. II., p. 14) I believe the characters there explained, especially the Gyrencephala and Lissencephala, can to a great extent be made to answer the purpose of very naturally separating each of the sub-divisions of the Placentalia into the higher and lower better than any other horizontal characters at present known; and in the case of such an important organ as the brain the interest attached to it may counterbalance the (in some instances) uncertain value of its structural characters (*vide* Addenda, p. 17). Table I. will I think show that the two sets of characters are in perfect harmony with each other.

The indefinite line which separates Gyrencephala from Lissencephala as far as regards convolutions only (the former in some instances not having convoluted brains and those of the latter being in some instances convoluted in a limited degree) has also its parallel in botanical classification where Monopetalæ and Polypetalæ (which are divisions formed by only horizontal characters) are separated by a much more indefinite line, the identity of the petals in the two divisions being in some instances complete and yet botanists are all agreed in adopting them as indispensable in practical research in consequence probably of the much greater number of genera in both of these divisions, so that the exceptions although numerous are comparatively very few. The Lissencephala are, however, further generally characterised by the "cerebrum unilobum," although there are among them exceptions more or less.

Botanists also generally if not entirely agree to the separation of the Epigynous plants as a very natural primary division of the class Exogens; and yet besides containing some families a great part of the genera of which are Perigynous, it contains some Hypogynous genera and one Hypoygnous family, which is quite the same exception to a rule as if the Gyrencephala contained an Order, all the genera having the character of "cerebrum unilobum." On the other hand the Hypogynous and Perigynous Divisions of Exogens contain many genera entirely Epigynous and certainly one if not two Epigynous families, and yet as far as I know we have not a shadow of a hope of escaping from this uncertainty and want of characters.

THE POSITION OF THE MAMMÆ

As the lowest families of the Mammalia, *i.e.*, the Didelphia have the mammary glands always ventral and the highest always pectoral (*Chiromys* being excluded from Quadrumana), it might be anticipated that their position would supply good characters for sub-divisions; but as long as Monodelphia were not separated into the Deciduate and Non-Deciduate sub-divisions their position was obviously not applicable for this purpose, farther than in distinguishing one family from another. But it appears to me that if the true station of *Elephas* and *Hyrax* is in the Non-Deciduate sub-division for which arguments will be adduced from their dentition, the position of these glands will then supply characters which make very natural sections, for carried to its fullest extent it implies the separation of *Hyrax* from Perissodactyla and of *Chiromys* from Quadrumana as distinct natural orders. As *Hyrax* as at present classified stands between Perissodactyla and Artiodactyla in which the mammæ are exclusively hypoventral or ventral, a more natural arrangement is obtained by its separation. In the position of the mammæ and number of the young *Hyrax* is between *Sus* and *Elephas*, the two axillary mammæ occupying a higher position than the uppermost pair in *Sus*, and two young ones are produced at one birth.

If we take as a rule that a family in which in some instances the mammæ are both pectoral and ventral or even inguinal, and yet in other instances exclusively pectoral should be placed in ventro-pectoralia, then, as far as I am able to learn, the present arrangement as regards their position will be quite correct, *i.e.*, contain no exceptions to the characters of the sub-divisions and place each family in its natural station. In the Edentata the mammæ are generally understood to be pectoral or nearly so, but Cuvier in his "Leçons d'Anatomie Comparée" states that in *Dasypus novem-cinctus*, there are four, of which two are pectoral and two inguinal and in other instances four, two of which are abdominal.

That the mammary glands are analogous to ovaries may be suggested from an approach in structure as well as in similarity in their functions, and if their position should lead to a more satisfactory arrangement of this highly interesting class, for which purpose each section has to be taken separately, it will be an advantage because it will be an extension of a principle which might be made use of to separate Aves from Mammalia, *i.e.*, the position of the ovaries. Aves are added to Table I to show their relation to Mammalia in their cerebral characters, *i.e.*, that in these horizontal characters they are related only to the Monotremata and Marsupialia, and the fact of their being all Lyencephalous may in some degree account for their near resemblance to each other in which respect they form a contrast to the great variety presented by the Placentalia. By including Bimana in this classification it is not intended to say that man was derived from Quadrumana as the other orders of Mammalia it is understood were derived from the Orders below them; Jeremiah, Chap. I, v. 5, is clearly opposed to such a supposition; the angelic host would, if incarnate, of course be classed with Bimana.

The explanation of the new terms made use of in Table I is that Pectoralia refers to the position of the mammæ exclusively on the upper part of the chest; Ventro-Pectoralia to their position both on the chest and the abdomen; Ventro-axillaria to their being axillary and inguinal; Ventralia to their position on the upper part of the abdomen or both on the upper and lower parts of it; and Hypo-ventralia to their position when situated exclusively on the lower part of the abdomen or near the pudenda and includes the inguinal position.

THE DENTITION.

The division of the Placentalia into Deciduata and Non-Deciduata having recently proved to be liable to unexpected and important exceptions, the *Lemuridæ* being non-deciduate and the Tardigrada among the Edentata highly deciduate, while *Manis* is non-deciduate, more reliable characters, or characters known to be liable to less important exceptions are very desirable for these two very natural divisions, which are by general consent admitted to be well established. Characters liable to less important exceptions, if to any, I believe to exist in the dentition, if it is admitted that certain characters, such as a larger number of teeth than usual, which occurs in some Cetacea, show a tendency to the inferior type of dentition occurring in the Reptiles, equally with the absence of teeth occurring in some Edentata; and in this view the Non-Deciduate may be named *Leptodental,* on account of the retrograde development or entire absence of the teeth, and the Deciduate, *Teleodental* as they are never deficient of well developed teeth and their number is always very limited.

Such a division of the Placentalia can I believe be practically founded to a great extent on the following propositions, whether completely so remains for competent zoologists to decide:—

1. That the Lissencephalous Leptodentals having more or less character of "cerebrum unilobum" are to be compared only with the Lissencephalous Teleodentals; and that the Gyrencephalous Leptodentals are to be compared only with the Gyrencephalous Teleodentals.

2. That a larger number of teeth than usual, *e.g.*, more than 44, the highest number among the diphyodonts be taken as indicating a lower degree of development comparatively with the Teleodental Orders. In the Cetacea they vary from 60 to 190 and in the priodont Armadillo among the Edentata, they amount to 98 (Linn. Proc. Zool., Vol. II., p. 5), and are on that account stationed as Leptodental. Also that a very reduced number of teeth, *e.g.*, the Probcscidea, be equally regarded as a leptodental character.

3. That very large incisors, *e.g.*, *Elephas, Monodon, and Hippopotamns,* be considered as shewing an inferior grade requiring exclusion from the teleodental section.

4. That the monophyodont character of the teeth (Edentata and Cetacea) be regarded as Leptodental in common with a deficiency of teeth, partial as in a part of the Ruminantia and Sirenia, or entire as in many of the Edentata.

5. That a want of differentiation in size and appearance between the premolars and the molars making them look like a row very nearly equal throughout, such as occurs in the Perissodactyla and most of the Artiodactyla also be regarded as a leptodental character as exhibiting a tendency to retrograde development.

6. Some of the Seals, *e.g.*, *Stenorynchus*, are perhaps scarcely Teleodental, in consequence of there being less than usual difference between the premolars and molars, but if it is admitted that carnivorous teeth in combination with the diphyodont character constitute a Teleodental dentition, they are then excluded from the Leptodental section. In Birds, Raptorial characters indicate one of the highest, if not the highest degree of development.

There then remains among the recent Non-Deciduate Orders only *Tapirus*, *Hippopotamus*, and the *Suidæ*, which have the appearance of being Teleodental; the two latter may, however, be readily distinguished from the Teleodental omnivorous and herbivorous orders by their large canines, usually projecting out of the mouth, and from the carnivorous Teleodentals among the Gyrencephala (with which alone I propose to compare them) by their teeth, especially the molars, not being carnivorous; but whether there are any other peculiarities they have which can be regarded as Leptodental, *i.e.*, retrograde as compared with Teleodental, remains a question.* The very large canine teeth occurring in these herbivorous or omnivorous animals, which are much larger than those of the teleodental, herbivorous and omnivorous, may perhaps be regarded as leptodental characters. In *Tapirus* the molars are scarcely more differentiated than in *Equus*, the foremost in the lower jaw being the highest.†

The molar teeth of Toxodontia are partly destitute of enamel, but whether this can be regarded as a leptodental character comparatively with the gyrencephalous Teleodentals remains for enquiry.

With regard to the division of the Teleodental section into Carnivorodental and Herbivoro- or Omnivorodental it may be considered as tenable if the Chiroptera are compared only with Rodentia agreeably with the first proposition, viz., that the Lissencephala be compared only with each other. There will then be this difference, that although the herbivorous Chiroptera have a dentition approaching in some particulars the Herbivorodentals, yet they have canines which in the Rodentia are wanting and thus the distinction in one point holds good. In the Insectivora there are, however, exceptions (*vide* Addenda, p. 17).

Chiromys differs from the Quadrumana in the position of the mammæ as much as *Equus* from *Elephas* and there being no connecting links in this character between them, this genus should perhaps be stationed as a distinct natural order, and its having been referred to Rodentia is a precedent for suggesting its separation from the Quadrumana. Are not the teeth, which are homologues of limbs or of their ungulate terminations, sufficient to separate it from the Quadrumana? The value of the position of the mammæ as a character indicating affinity will, *primâ facie*, appear doubtful if *Castor* among the Rodentia and *Chiromys* are compared, the former having two mammæ on the breast and none elsewhere, while the latter have two inguinal and none elsewhere; but if it is taken into account that *Chiromys* is much lower in its development than any of the Gyrencephalous Herbivorodentals, so much so that when first discovered it was supposed to be a species of *Sciurus*, that difficulty will so far disappear that there will be no necessity for regarding it as a complete exception to a rule, such as non-deciduate Lemuridæ and deciduate Tardigrada.

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* The large prominent canine teeth of the males of the *Suidæ* of course are not to be seen in the females, and possibly not in all the species even in the males to such an extent as to show the leptodental character, but in case this objection should prove correct, it may be suggested that the Amphibia are separated from Fishes by the possession of well developed limbs, although all of them have not that character, the exceptions being much gteater than are likely to occur as regards the teeth. Sponges, also, are separared from other Protozoa by being *Diploblastic*, although only a very few of the genera have that character, and in most of them it is entirely wanting (*vide* Addenda, p .17).

† *Hyrax* is stated to have molar teeth much like those of *Rhinoceros*, and if the resemblance is very close they are leptodental, from the præmolars and molars being scarcely differentiated, and may be even more so, from their greater number, 28, in proportion to the incisors (*vide* Addenda, p. 17).

To what extent these dental characters can be made use of for practical purposes remains for further enquiry, but until better can be discovered they may it is hoped answer a useful purpose in classification. The deciduate character might perhaps serve to separate a section of the Leptodental families, viz., Proboscidea Hyracida and Edentata as being partly or wholly deciduate, and Sirenia if they are deciduate, which from being gyrencephalous and having the mammæ pectoral is probable.

REPTILIA AND AMPHIBIA.

The position of the oviducts in the higher Reptiles, *i.e.*, the Loricata and Chelonia, appeared the most questionable part of the arrangement, as regards the Vertebrata, and to avoid error I examined a Chameleon, and find that they are quite posterior to the intestine, like the oviducts, whether one or two, in Fishes; and that towards their external terminations they join together so as to appear like a single tube, but their cavities do not communicate and they open by separate orifices into the cloaca. In the Tortoise the oviducts are very large and lie on the sides of the intestine, but open behind it as in the Chameleon, being separated at their terminations by only a very thin septum, so that their orifices are close together, which becomes more obvious if they are distended, for which purpose cotton wool answers well. The oviducts of the Frog are situated like those of the Tortoise, lying in apposition at their external orifices, which open into the cloaca, being at that part separated from each other by only a thin partition of cellular membrane; this, however, cannot be distinctly seen, or, at least, not without much difficulty, unless they are fully distended.

PISCES.

It has become a generally accepted opinion that *Amphioxus* is derived from the Ascidia especially on account of its being epicœlous in common with that class and with other Vertebrata, on which account Ascidia have even been separated from Mollusca and associated with the Vertebrata. But as all the lower Fishes have but one oviduct, which is posterior, and the Ascidia two, more or less lateral, this would be impossible, according to the foregoing theory, as much so as to suppose that a Monodelphian animal having the oviduct or uterus anterior could give origin to a Didelphian. I should suppose, therefore, either that Amphioxus was derived from *Salpida*, where the oviduct is single, or else that there existed in past ages an Ascidian with only one oviduct which was posterior like that of the *Salpida*, and that it was from this primitive Ascidian that *Amphioxus* was derived.[*] *Salpa*, however, is viviparous, the embryo being connected with the circulatory system of its parent by a distinct blood vessel, the former having a distinct circulation of its own. The abdominal pore of *Amphioxus* is, most probably, only the same kind of aperture as an extemporized opening, especially as there are openings of this kind in the branchial sac for the passage of water into the abdominal cavity, and therefore the oviduct, if formed, might be expected to occupy the same situation as in other monodelphian Fishes.

MOLLUSCA.

The position of the oviduct in the Mollusca when it is single is in some cases obscured by an unusual degree of displacement of the intestine, but, as far as my observations have gone, the oviduct and intestine always maintain the same relation to each other, which would obtain if no displacement had taken place. This displacement attains its greatest degree, or nearly so, in the Branchiogasteropoda, of which the Whelk and Periwinkle are common examples. In these instances the oviduct and intestine are placed on the right side of the body, but yet so far in front as to be situated on the anterior side, if the œsophagus is taken as the axis. *i.e.*, supposing a horizontal line to extend right and left of the œsophagus, the oviduct and intestine will be found below that line: they lie side by side, the oviduct being nearer the median line of the front of the body, and therefore more anterior than the intestine. But there may be perhaps, no necessity for this explanation, because, from a comparison of this class with Lamellibranchiata and Brachiopoda, it will become evident that the oviducts, if present in them, would, in all probability, occupy very nearly the same position as the organs of Bojanus (which perform the function of oviducts) in the former, and the oviducal passages in the latter (*Philos. Trans.* 1858, p. 791), and both these are obviously anterior to the intestine. I believe it will be admitted that in the Lamellibranchiata the position of the intestine is normal, and therefore its normal position in the Branchiogasteropoda is the same as in that class because in *Plocamophorus* and other genera of Branchiogasteropoda (*Trans. Linn. Soc.*, XXIV., p. 511), it occupies, in conjunction with the renal organ, the same position as in Lamellibranchiata, terminating at the posterior part of the body. It therefore follows that the oviduct in this class advances to a greater extent towards the anterior part of the body relatively with the intestine when the latter is in its normal position, than when it becomes displaced as in Pulmogasteropoda and Pteropoda; because the oviduct advances towards the anterior part of the body, leaving the intestine in its original and normal position. *Chiton* has two sexual orifices which are bilaterally symmetrical and therefore could be placed in Monodelphia only as an exception, and from the recent researches of Prof. Ray Lankester (*Ann. Nat. Hist.*, 3rd Ser. XX., 334), there remains scarcely a doubt that *Patella* has also two sexual orifices one on each side of the head.

Although the organs of Bojanus in Lamellibranchiata and the oviducal passages in Brachiopoda are not oviducts, but only renal organs, yet as oviducts, when present, always either accompany the renal organs or are anterior to them, the position of the latter indicates that of the former in these classes as far as regards their station being anterior to the intestine. The renal organs in these classes being far in advance of the intestine, their position may therefore be safely taken as a guide to decide the position the oviducts would occupy relatively with the intestine if they were formed.

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[*] Since the above was written there has appeared in the Trans. Linn. Soc., Ser. 2, Zool., Vol. I., p. 287, a description of a new Ascidian genus, *Hypobithius*, having but one oviduct.

To some zoologists the position of Branchiogasteropoda and Pulmogasteropoda may perhaps appear unnatural, as being—as far as regards their lateral relations—in advance of Cephalopoda; but as the classes of Mollusca cannot be made to form a natural lineal series, their position in Table II. will be in some, if not in most respects, the most natural they could occupy. The tentacular appendages of Cephalopoda are analogous to the tentacles of Polyzoa; the body is bent forward upon itself without any lateral obliquity as in Polyzoa, and their inverted mode of progression is like that of some of the *Actiniæ* and of a *Tubularia* before it becomes fixed; and these approaches between them and the lower Acephala, together with the fact that Cephalopoda are all aquatic, may raise a doubt as to whether they should be regarded in all their characters as the highest class of the Mollusca, as the highest orders of Vertebrata are terrestrial. Two or three difficulties of this kind occur in the Vegetable Kingdom, but they scarcely extend to the highest divisions. *Amphioxus*, although it takes its station above Cephalopoda, has a much lower developed brain and vascular system (the heart being absent) than they have, which may assist in removing the difficulty to which reference has been made as regards the position of Cephalopoda relatively with Pulmogasteropoda, &c. May not Cephalopoda be regarded as a branch of Ascidioda rather than of Lamellibranchiata? it being admitted that *Amphioxus* takes its origin from so distant a class, there would be no difficulty as regards distance.

MOLLUSCOIDA.—Prof. Huxley has clearly demonstrated (*Trans. Linn. Soc.* XXIII., Pl. 30 and 31) that in *Pyrosoma* the oviduct is single and posterior to the alimentary canal. The variable position of the oviducts in some genera of Ascidioida, which has been described by Mr. Albany Hancock (*Linn. Proc. Zool.*, IX., 309), may not, perhaps, occasion any difficulty, but—on the contrary—prove to be a guide to the natural arrangement of this class, because its lowest forms in which development has been, as it were, arrested, have a single oviduct posterior. With regard to *Pelonaia*, he observes that he has "not met with this peculiar arrangement of the genitalia in any other species" (*l. c.* p. 318), *i.e.*, of the Tunicata;—supposing, however, the oviducts and intestine in this instance to turn downwards to the lower end of the body, there would then be no necessity for placing that genus in Prodelphia. Whether those genera in which he has described the two oviducts as opening on the sides of the anus should be placed in Prodelphia or Notodelphia may be a question, but I expect in the latter; if, however, they are placed in Prodelphia, that position would not make the arrangement of the Mollusca unnatural.

Dr. Allman having stated that the ovary in Polyzoa is posterior, will be accepted as sufficiently proving its position, and this might be expected to be the case from Prof. Huxley's observations on the Cheilostome Polyzoa (*Quart. Journ. Micr. Soc.*, 1st. Ser. IV., 191). It appears, therefore, very improbable that Polyzoa are derived from Vermes, because in them the oviduct is either single and anterior, as in the Hirudinea, or there are two either lying close together in front or more or less lateral as in *Lumbricus*.

Prof. A. Nicholson and Dr. J. Murie have stated in a memoir on Stromatopora, a new

Order of Calcareous Sponges, recently read at the Linnean Society* that some examples of it show a striking resemblance to a part of the Polyzoa, although of an uncertain character, but they add that possibly further research may bridge over difficulties, from which it would appear that this opinion that Polyzoa are derived from Vermes has not been adopted by them, the latter not being mentioned; it may be suggested that the transition to Polyzoa would be through Echinodermata.

As there are so many evidences that there is a close connection between the Annelida and the Molluscoida, perhaps this may be considered as sufficiently proved, but from the position of the oviduct it appears that Polyzoa might have been derived from Echinodermata, which may have occurred through extinct genera, as the larva has to some extent, the same development, and their *avicularia* may perhaps be compared to the *pedicellariæ* of Echinodermata. Should this appear improbable Polyzoa might be derived from *Phoronis* as being reduced forms of that genus, or more probably from an allied extinct genus having an oviduct with only one opening.

CRUSTACEA.

The genus *Sacculina* (Leuckart in Ann. Nat. Hist., Vol. IV., 3rd Ser., p. 422) has a single orifice on the lower anterior part of the body, which is the ovarian outlet, and as the intestinal canal is entirely wanting, may not this be regarded as an extemporized opening for the "brood chamber, which occupies by far the greater part of the body;" agreeably with which it is stated (l. c. p. 429) that "there are two pairs of lateral orifices opening into this cavity" (*i.e.*, the brood chamber), and that "Rathke regarded two of these apertures as the openings of the ovary;" the external opening, therefore, has no connection with the oviducts. It becomes an interesting question whether such reduced forms as *Macrobiotus* among the Arachnida, in which the ovary is single," have two oviducts; a still more reduced form, however, viz., *Pentastoma*, the ovary of which is described as a large sac, is stated to have two oviducts.

ANNELIDA.

I have not had an opportunity of examining *Sagitta*, but Mr. Busk has clearly pointed out (*Quart. Journ. Micr. Sc.*, 1st Ser., IV., 14) that the oviducts open on the posterior side of the membranous expansions termed "fins," which he describes as "all in the same plane," and as springing "from a line equidistant between the dorsal and ventral surfaces," which might also be expected from the accompanying figures. The oviducts are therefore distinctly behind the lowest portion of the intestine, and being straight, their external orifices do not curve at all forward, so that this genus could not be stationed in Prodelphia, and it may probably on this account be regarded as a distinct Order. From the observations of Krohn (l.c.) it would appear that the "fins" are closely allied to the setæ of Annelids, so far as that he has often seen their contained fibres "bare for a considerable extent."

It is obvious from Dr. F. D. Dyster's figures of *Phoronis* (*Trans. Linn. Soc.*, Vol. XXII., Pl. 44), that it is doubled on itself forwards, by which the lower end of the body becomes, to some extent, turned upwards so as to be in front of the middle and, to some extent, of the upper portion—as in Polyzoa and Cephalopoda—and the oviduct lying externally in front of the doubled portion and directly over the intestine, occupies precisely the same position relatively to it, as those of Cephalopoda. Supposing the intestine and oviduct to be straight, and terminate at the lower end of the body, the oviduct (which is single, but opens externally by two symmetrical orifices) would then become posterior to it. In its single oviduct posterior, it differs from the capitibranchiate Annelida, and very widely, and Gephyrea differ from it in the anal opening, which is in the upper half of the body, being dorsal (in one species if not in all in the mesial line), which therefore cannot be the consequence of the animal becoming doubled on itself forwards, as in *Phoronis*.

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* This was written very shortly after the paper was read.

It may be taken as a rule when the position of the oviducts is unknown, from the female not having been seen or examined, that the presence of two male organs, one opening on either side, makes it probable either that the oviducts are the same in number and situation as these organs, or are anterior, opening on the front surface of the body. And this comparison also supplies a conjecture, or well-nigh reliable evidence, as regards the position the oviducts would occupy if present in the higher Annelida, where they are deficient, and the ova escape through extemporised openings in the walls of the perivisceral cavity; thus in *Tomopteris* the testes are situated on the sides of the body and each of them opens externally by a small orifice, *Trans. Linn. Soc.*, XXIII., Pl. 7.

Hirudinea are stationed with the Entozoa on account of their single oviduct, and consistently with this view of their affinities De Blainville regards them as intermediate between the Entozoa and Annelida; Prof. Agassiz has expressly stated his opinion that the affinities of this tribe are closer with the Tremadota than with Annelida, and also Leuckart; and Diesing in his "Revision der Myzhelminthen," 1858, places Hirudinea and Trematoda in the same order, Myzhelmintha. Very recently Dr. Denis Macdonald has discovered a Trematode so very much like a leech that at first sight he mistook it for one, and on close examination he also found it had a large caudal sucker the structure of which much resembled that of a large black leech, that of the Trematode having 120 alveoli in four rows and that of the Leech 150 "very much after the manner of the Trematode," *Trans. Linn. Soc.*, Zool., I., 209, Pl. XXXIV., figs. 11 and 12. He further states that "the disk or foot is in form not unlike that of *Aspidogaster* (another genus of Trematoda) but of different structure"; so that it more nearly resembles that of the Leech referred to than that of this nearly allied genus, (l.c., p. 209). And according to Semper's recently published statements *Malacobdella* is a true Nematoid and not a Leech.

Annelida are stationed in Table II., as a Division entirely distinct from Annulosa, and of equal value with that Division, because a part of the Orders are monodelphian, and therefore terminate a Race derived from the Echinodermata, Hirudinea being its highest form.

ECHINODERMATA.

In *Holothuria* the oviducts are reduced to one, there being but one ovary, which is posterior to the alimentary canal, and its external opening is on the dorsal side of the neck near the head, to which the oviduct ascends, the ovary being oblong, and its opposite end extending some distance down the back of the body. The Holothuridea, therefore, have the same relation to the Annulosa as limited in Table II., as the Ascidioida with a single oviduct have to the classes of Mollusca above them, and this harmony in the system may deserve notice, because it holds good also in most of the classes of the Annulosa and Mollusca; viz., Annelida and Crustacea occupy the same position relatively with the two classes above them as Brachiopoda and Lamellibranchiata do to the three classes above them on the right; and Insecta and Myriapoda occupy the same high position as Pulmogasteropoda and Branchiogasteropoda; and it is remarkable also that Branchiogasteropoda, like Myriapoda, are in part didelphian.

With reference to the question from what Class or Order could the Echinodermata have taken their origin, it deserves notice that Mr. T. Austin has stated in his "Observations on the Connection between the Crinoideæ and the Echinodermata" (Ann. Nat. Hist. 2nd Ser. VIII., p. 286), that "in *Apiocrinus* (Crinoidea) I have examined specimens ranging from the embryonic monad to the mature and perfect animal which at the first dawn of existence seems to have borne some resemblance to a minute *Actinia* encased in a calcareous integument. These animals were oviparous, since from the smallness of these rudimentary specimens it is evident they were in their earliest state of existence mere monads."

CŒLENTERATA.

Although *Actinia* shows evidences of bilaterality, the reproductive organs are equally developed in the mesentery all round the body, there being no tendency to suppression in any direction; yet a figure of *Beröe pileus,* more recently named *Cydippe,* a genus of Ctenophora (*Trans. Zool. Soc.*, I., Pl. II., Fig. 1), by Dr. Robert E. Grant the well known and distinguished comparative anatomist, appears to supply very satisfactory evidence that the reproductive organs are entirely deficient on the anterior side of the body, between the surface and the alimentary canal. He has, moreover, described the reproductive organs so far as to state that "The ovaries extend along the sides of the intestine" (*i.e.*, the stomach and infundibulum), from which it is to be inferred that there are only two which are quite distinct as seen in the figure, which is from his own pencil, representing the two ovaries with perfectly defined margins, so that the stomach lies between them. If, therefore, there were two oviducts, they would probably be situated on the sides of the alimentary canal, perhaps inclining neither to the anterior nor posterior side, or considering the near affinity of the Cœlenterata to Echinodermata they might unite and form one duct posterior as in Fishes.

PROTOZOA.

That the endoplast is a reproductive organ which divides into or gives off a number of embryos there appears no reason to doubt; and the constancy of its position at one point beneath, not in the cortical layer, in *Paramœcium* shows that it is fixed; and from a figure of *P. bursaria* with its description by Prof. Huxley (Anatomy of Invertebrated Animals, p. 104, Fig. 10) its position is on the opposite side of the body to the mouth and gullet. Although the contents of their bodies rotate in some of them yet in others there is no movement of this substance. From this it would appear that the original position of the ovary in the animal kingdom is posterior, and this receives some degree of confirmation from the position of the two ovaries in Ctenophora, and that of the single one in Holothuridea, v. Table II.

ADDENDA.

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The sub-divisions, Gyrencephalous and Lissencephalous will probably, to some zoologists, appear impracticable. As an apology for quoting them I may offer as an explanation that until a Rodent is discovered having the brain of a Chimpanzee, a Bat the brain of a Lion or Bear, an Insectivorous animal the brain of a Seal, and an Ant-eater the brain of an Elephant, I consider these sub-divisions quite as practicable and indispensable as the divisions Monopetalous, Polypetalous and Apetalous in botany. But if the Lyencephala could not well, in all instances, be distinguished from the Lissencephala by their cerebral characters, that would be comparatively of little consequence, because they are known by their didelphian character.

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To the six rules for distinguishing the Leptodental from the Teleodental sub-division is to be added that:—

A large diastema between the pre-molars and canines or incisors, the teeth of the mandible not being diprotodont (the 2-toothed character common to all Rodents) shows that the animal belongs to the Leptodental sub-division. By this diastema, together with the molars and pre-molars being scarcely differentiated, *Hyrax* is separated from the Teleodental sub-division; the mandible has four incisors very nearly equal in form and size.

Hyrax may in all probability be very naturally separated from the Teleodental sub-division by the molar teeth being rhinocerotic, a character otherwise peculiar to the *Rhinoceros*, as they are stated to closely resemble them in form and structure, the patterns of both the upper and lower molars being very similar to those of the corresponding teeth of that genus which is one of those which are most distant from the Teleodental sub-division, and therefore any peculiarity of character in the teeth is the more likely to belong exclusively to the leptodental series, and, so far, may be regarded as a leptodental character, provided the two sub-divisions are otherwise quite natural.

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Among the skulls of the Suidæ in the British Museum there is one having such very large hinder molars that at first sight they look as if composed of three each; this probably may be regarded as a leptodental character. This is not apparent in *Dicotyles*, where, however, the diastema between the canines and molars is large. The exceedingly large canines, however, of some species exclude this Order from the herbivorous teleodental section.

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Erinaceus and *Sorex* are the exceptions referred to in the Insectivora (p. 10, line 4 from the base) as having no canine teeth.

The Hedgehog has been described as not having canine teeth, and in the lower jaw this is apparently the case, but if the upper jaw is compared with that of *Gymnurus Rafflesii* the teeth will be found to be exactly the same, except that in the latter there is one more pre-molar.

The similarity of the two is such (those of *Gymnurus* being only slightly more prominent) that if the Hedgehog has no canine teeth, the same must be true of *Gymnurus*, whereas canine teeth are obviously present both in the upper and lower jaw.* The two first pre-molars, the canines and the incisors of the upper jaw are so much alike that if these alone are taken for comparison, the dentition of the former might be mistaken for that of the latter. In the lower jaw of the Hedgehog the canine teeth are represented, if present, by two of the incisors, and as two of the lateral of these, although smaller than the first, are higher than the others, they may not improbably represent them; and if so, the dentition of the Hedgehog seems to show that it is position which makes a tooth a canine, otherwise how could a milk tooth in an early stage, before it emerged, be known to be a canine?

With regard to *Sorex*, which has also been described as having no canines, it may be advanced that as there is no diastema between the teeth, it seems very probable that the canine teeth are represented by teeth closely resembling incisors, to which they are so far similar on account of the adjoining incisors being, if I recollect right, in some degree pointed, that they have been described as incisors; but are they not sufficiently pointed to be considered as canines?

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An extinct Cetacean *Zeuglodon* has been described as having a part of the teeth diphyodont, but this is doubted by reliable authority; supposing, however, this mode of dentition to occur among the Cetaceans, all the teeth being diphyodont, it would then become a question as to whether the teeth are not very numerous.

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Among the Gyrencephalous Teleodentals *Chiromys* is an exception, on account of the large diastema behind the incisors, although canines are formed as milk teeth, which at that period lessen it. To avoid an unnatural arrangement a rule may be introduced to the effect that an animal having strictly the very singular dentition of a Rodent as regards both the upper and lower incisors and a large diastema behind them, be regarded as teleodental. This rule is perhaps quite admissable, because if *Chiromys* were placed in the Lissencephala to which it was formerly referred, it would be teleodental as regards the Edentata, and then the proposed rule would not be wanted. And furthermore, to regard such a dentition as teleodental would not be unnatural, because Rodentia are close upon Quadrumana, *Chiromys* being the connecting link; and this dentition has its origin in the Diprotodont Marsupials (*Phascolomys*), the form of the mandible of which, especially in *Hypsiprymnus*, much resembles that of the Rodentia, although the upper incisors differ. In fact it has been acknowledged for some time past that all the Orders now stationed in Table I. as teleodental are derived exclusively from Marsupialia; and I would suggest that they have no connection whatever with any other Mammalian Orders, except the Marsupialian.

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* This can be very well seen in the specimens in the Museum of the Royal College of Surgeons.

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It would be inaccurate to refer to the teeth of the Carnivorodental Subdivision Table I. as always strictly carnivorous, because the frugivorous Cheiroptera are an exception although other genera of that Order have the canine characters of the teeth strongly marked. The Carnivorodental Subdivision have uniformly carnivorous teeth only in the Gyrencephalous section; in the Lissencephalous section however, the Orders stationed as Carnivorodental (although they are not entirely so) are completely distinguished (including the frugivirous Cheiroptera) from the Lissencephalous Herbivorodentals by having canine teeth. Carnivorodental is therefore not a sufficiently expressive name for this very natural section, although it indicates its principle character; but if the Gyrencephalous families are compared only with the Gyrencephalous and the Lissencephalous only with the Lissencephalous (which is the principle on which these sub-divisions are founded), the separation between the two sub-divisions appears complete and quite natural; for *Erinaceus* and *Sorex*, vide p. 18.

But should a frugivorous. Bear be discovered having teeth essentially the same as a Quadrumanous animal in which the canines are large, or a frugivorous Bat destitute of canines, yet the skulls of the animals would satisfactorily show not only the Order to which each of them belonged, but even their position in it, so that the Carnivorodental Subdivison might be named *Carnivorocranial*, or (if such a term would not include the Insectivora) *Carno-Insectivorocranial*, and the Herbivorodental, *Herbivorocranial.*

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Mr. W. S. Dallas, in his valuable work, "The Animal Kingdom" p. 102, states that "the most remarkable character presented by the Polyophthalmidæ (Annelida) is the structure of the head, which bears a pair of lobes covered with cilia which, like similar organs of the Rotifera can be retracted and protruded at pleasure. From these we pass naturally to the Articulata." I find on reference to M. de Quatrefages' paper on *Polyophthalmus* (Annales des Sciences Naturelles, 3rd. Ser. Vol. XIII., 1850,) that he has figured the two ciliated lobes, the similarity of which to the wheels which occur among the Rotifera, is so nearly identical as to leave but little doubt as regards the true station of the Rotifera.

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Hampstead.

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As horns may be regarded as homologous either with limbs or teeth, it will be decidedly the latter with which they may be the more aptly compared, as they are often deciduous, and even more so than is known to occur in the teeth of Crocodiles. This view of their true nature being admitted, they may be regarded as a third set of teeth, and therefore, as showing that such animals belong to the leptodental section of the Mammalia, as although they may not have too many teeth to be stationed as teleodental, yet they have an additional set, although it consists of only one or two. In the *Rhinoceros* they may be regarded as two incisors combined into one, and in the Ruminantia, from their position and greater size as representing canines, being formed especially for defence. Very rarely a third set of teeth occurs in Reptiles, although in a different way, the mandible having two sets one within the other.

TELEODENTAL.

OR RACE OF THE MARSUPIALIA.
(Synonymous with the *olim* Deciduata).

	RO-DENTAL. HE INSECTIVORA.		HERBIVORO-DENTAL. OR RACE OF THE RODENTIA.		
	VENTRO-PECTORALIA.	PECTORALIA.	HYPOVENTRALIA.	VENTRO-PECTORALIA.	PECTORALIA.
PLACENTALIA.			ALL. 2. **CHIROMYDA.**		ALL. 4. **BIMANA.**
	Plantigrada one genus, viz., Ursus, 4 pectoral and 2 ventral.			ALL. 3. § Lemuridæ in part, but only a few instances.	**QUADRUMANA.**
	ALL. 1. **INSECTIVORA.** Derived from carnivorous Marsupialia, viz. Didelphys.	Galeopithecus and Chrysochloris. **CHEIROPTERA.**		ALL. 1. **RODENTIA.** Derived from herbivorous Marsupialia, viz., Phascolomys.	One genus, viz. Castor.
	ALL. 2. **MARSUPIALIA.** **Mammæ ventral.**				

ous Division the surface of
e of development, besides
tions if present are few and
maller than in other Mam-
away at parturition in that

the latter of which there are only three instances.

VERTEBRATE DIVISION,

OR RACE OF THE POLYZOA.

NOTODELPHIA.	PRODELPHIA.